

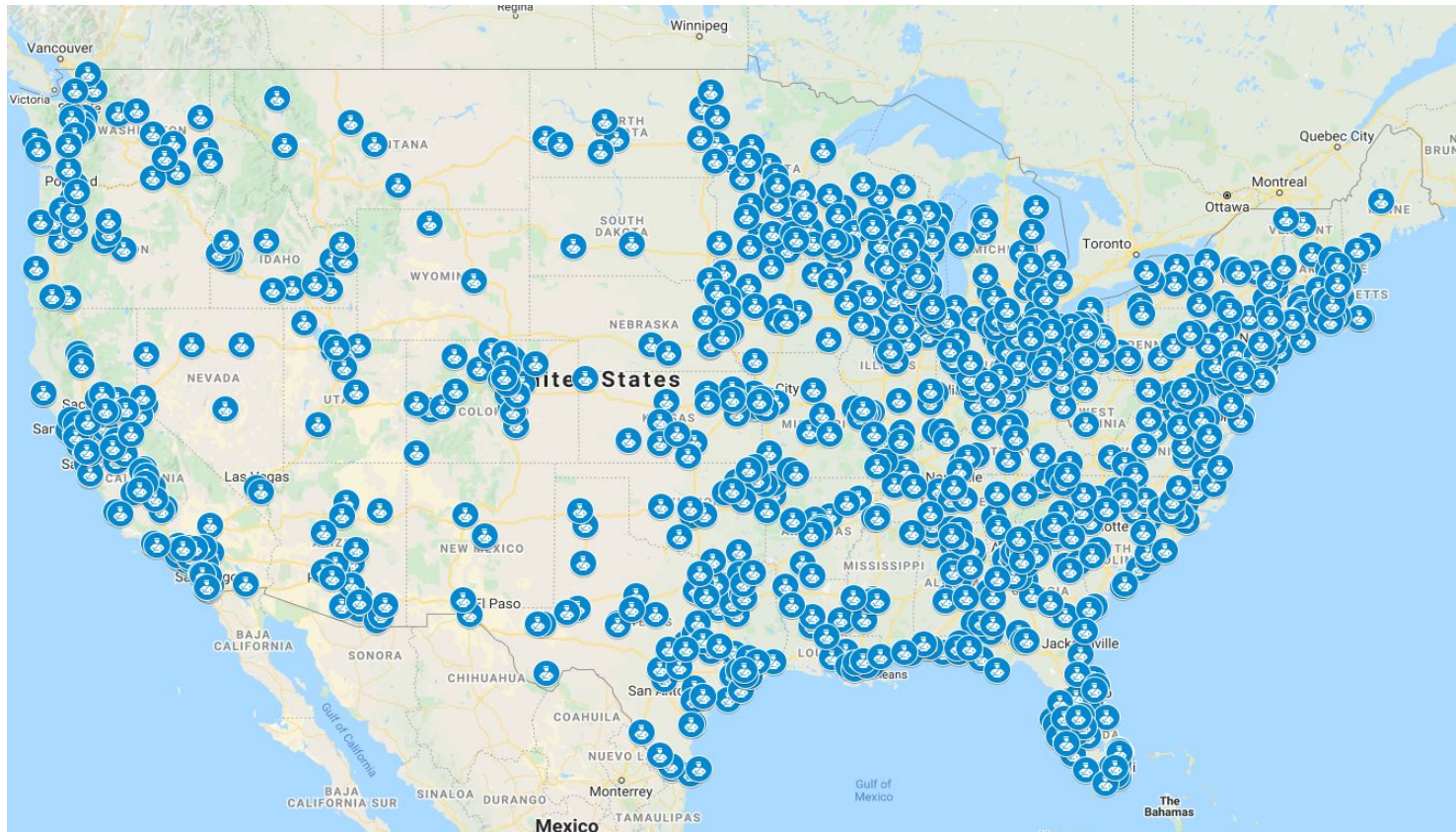
# The Use of Unmanned Aerial Systems (UAS) for Traffic Incident Management



TALKING TIM – JULY 22, 2020

GRADY CARRICK  
ENFORCEMENT ENGINEERING, INC.

# US Police Agencies Using UAS



(Does not include Alaska (3) and Hawaii (2)) Source: Center for the Study of the Drone at Bard College

# Certificated Remote Pilots including Commercial Operators

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Step 1: Learn the Rules

Step 2: Become an FAA-Certified Drone Pilot by Passing the Knowledge Test

Step 3: Register aircraft with the FAA



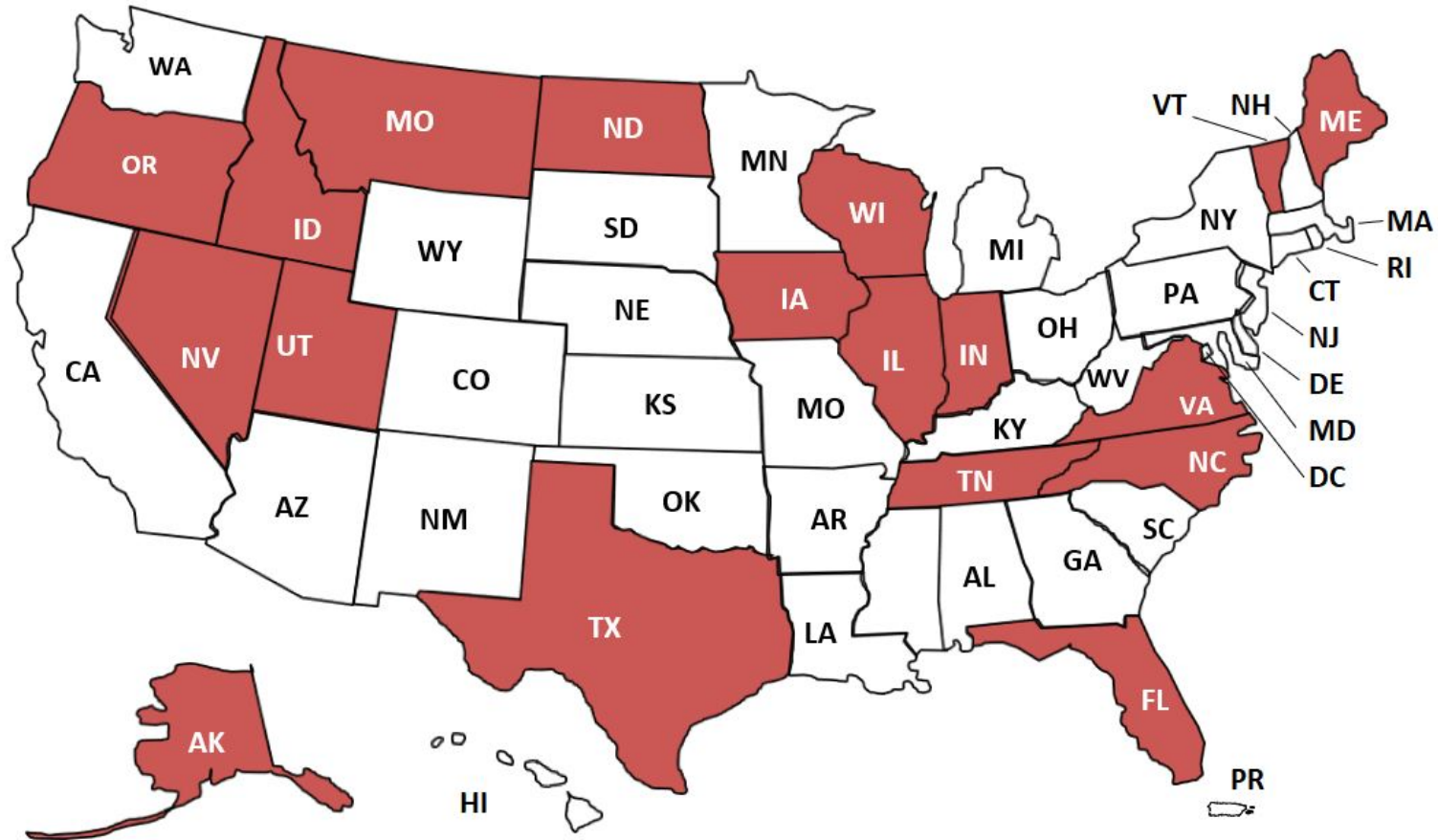
Source: Federal Aviation Administration (FAA)

Alternative to Part 107 License: Public Aircraft Operator Certificate of Authorization (COA) from the Federal Aviation Administration (FAA) allows agency to self-certify drone pilots and drones for flights to perform governmental functions.



# States with law enforcement UAS warrant requirement

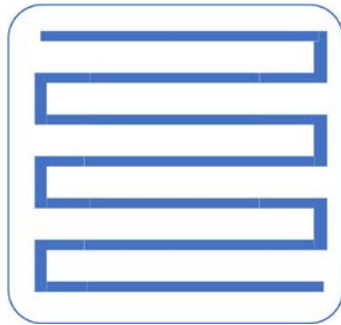
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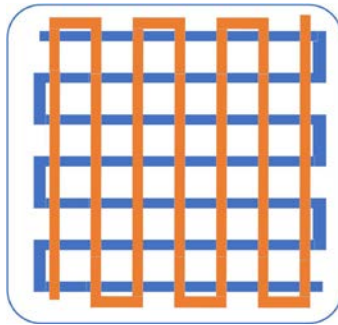
Source: Enforcement Engineering, Inc.

# UAS for TIM: How It Works.

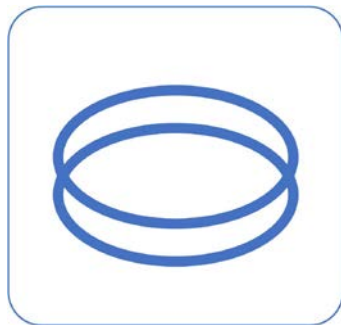
## Flight Pattern and Checking Airspace:



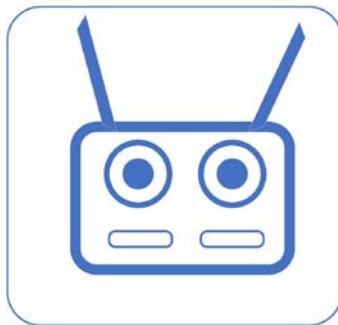
GRID



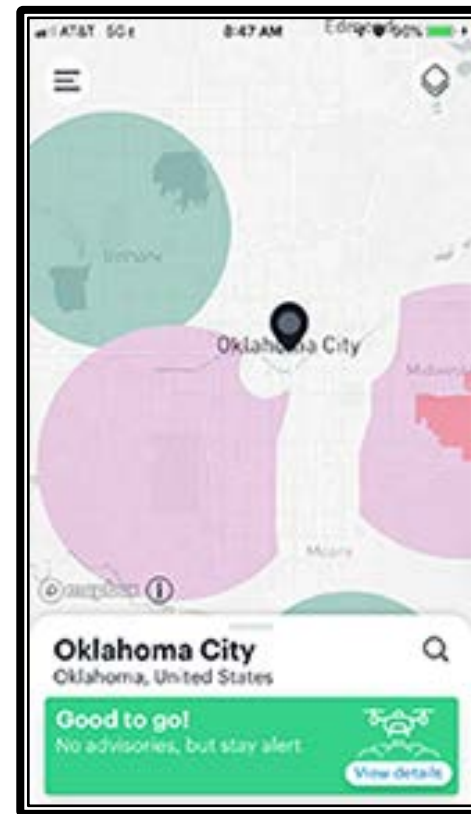
DOUBLE GRID



ORBIT



FREE FLIGHT

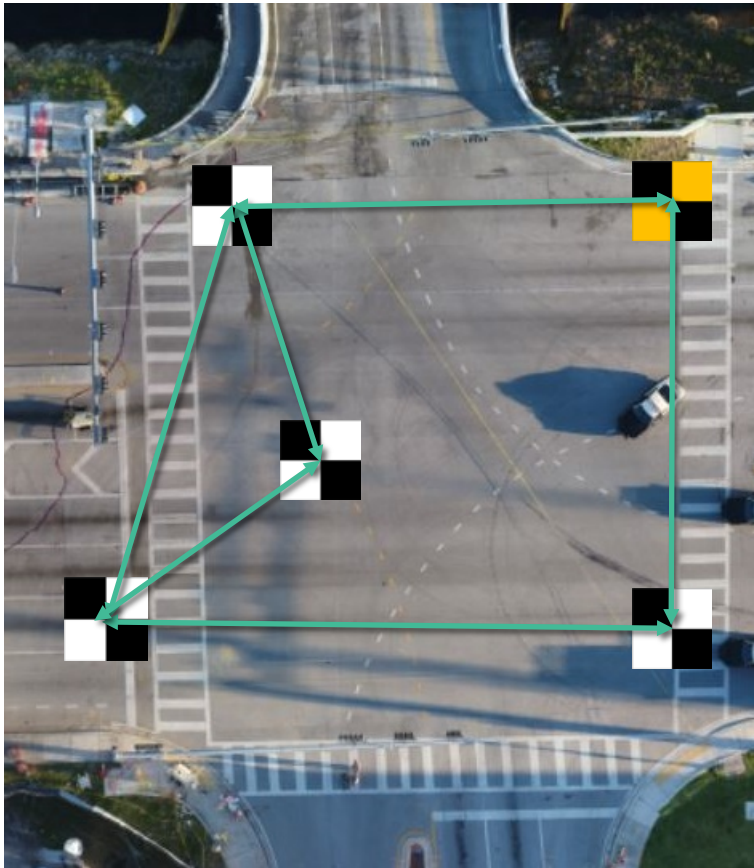


Source: FAA B4UFLY Application

# UAS for TIM: How It Works.

## Ground Control Points (GCP):

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Source: Florida Highway Patrol

Painted marks, placards, or photo features to provide scale.

Capture Known Measurements.

Steel Tape.

Total Station.

RTK GPS/GNSS Rover.

Portable GPS Device.

Smart GCP.

**Relative accuracy** is accuracy comparing features within a scene.

**Absolute accuracy** is the accuracy of the scene in relation to its true position on the planet.

# Back Office Processing.

Aerial  
Images



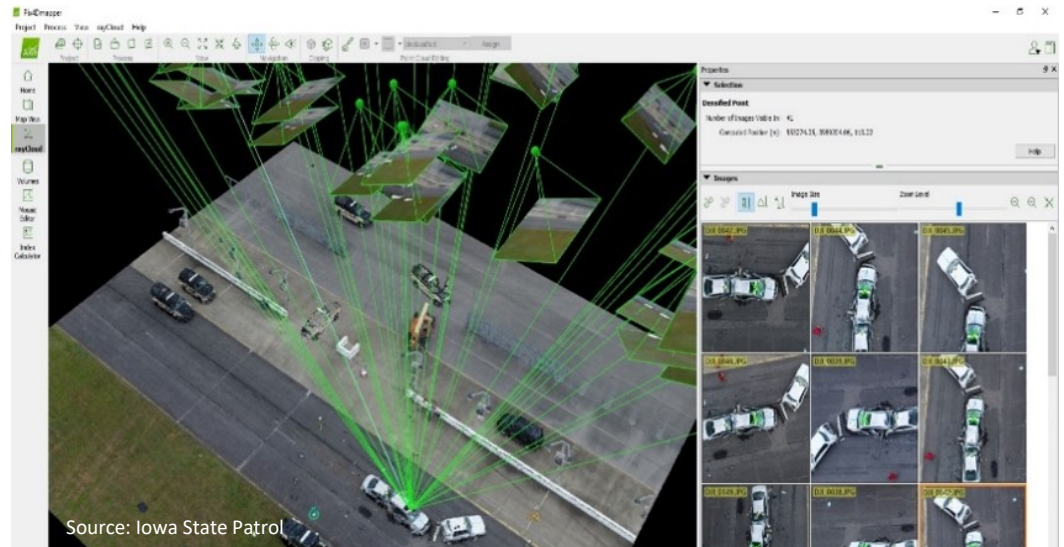
Image  
Process



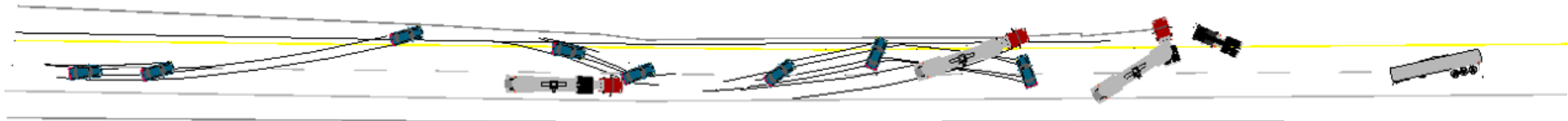
Drawing  
Application



Source: Dmitry Kalinovsky/shutterstock.com



Source: Iowa State Patrol



I 295 Southbound

Source: Maine State Police

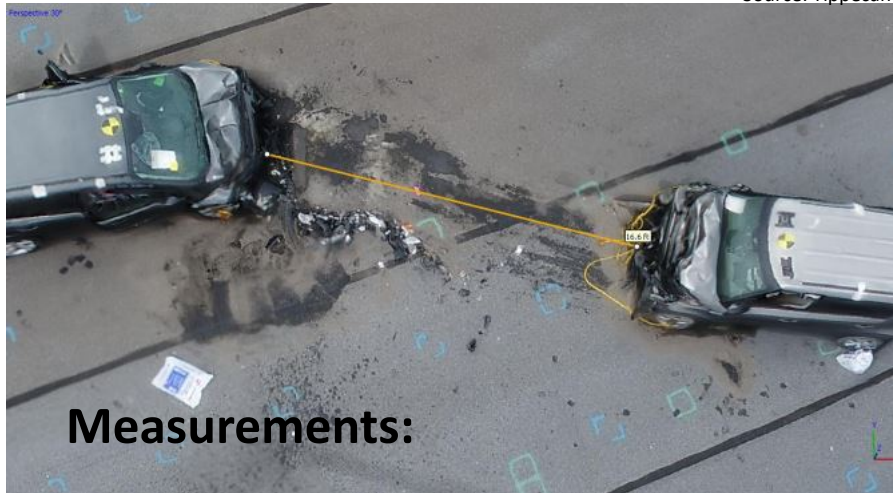


# The Results.



**Orthomosaic:**

Source: Tippecanoe Sheriff's Office



**Measurements:**

Source: North Carolina Department of Transportation



**3D Modeling:**

Source: Maine State Police

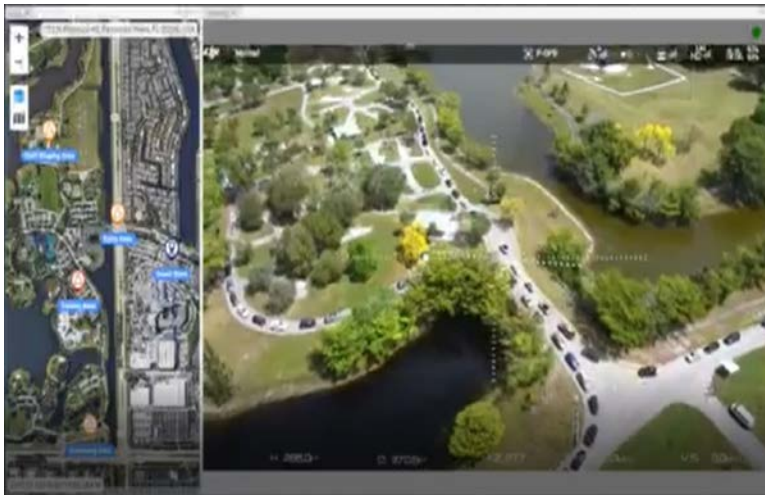


# UAS for TIM.



Source: FHWA

- Disaster response
- Situational awareness
- Detour route monitoring
- Incident verification
- Queue detection and monitoring
- Secondary crash detection



Source: Florida Highway Patrol



Source: Florida Highway Patrol

# Benefits of UAS for TIM

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## **Saves Lives**

- Better situational awareness.
- Safety of incident responders.
- Reduced likelihood of secondary crashes.
- Less time in roadway.

## **Saves Time**

- Saves time required for data collection.
- Shorter road/lane closures.
- Less time on scene.
- Faster crash investigations.

## **Saves Money**

- Lower cost vs manned aircraft.
- Lower cost of investigative man hours.
- Fewer Impacts on commerce.
- Cost-effective Measuring and Mapping Solution:
  - Scalable vs Other Technology.
  - Vehicle storage vs central storage .
  - Cheaper vs Other Technology.
- Improved investigative outputs:
  - Aerial views.
  - Modeling.
  - Easy for layperson to understand.
  - Fewer measuring errors.
  - Is easy to use.

# Benefits of UAS for TIM

## Direct Cost Savings

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### Estimated Equipment Acquisition and Recurring Cost

	UAS	Total Station	3D Scanner
Startup Cost	\$8,000-\$10,000	\$15,000-\$30,000	\$50,000-\$80,000
Annual Cost	<\$1,000	\$2,000	\$5,000



# Evidence of Success.

## Washington State Patrol:

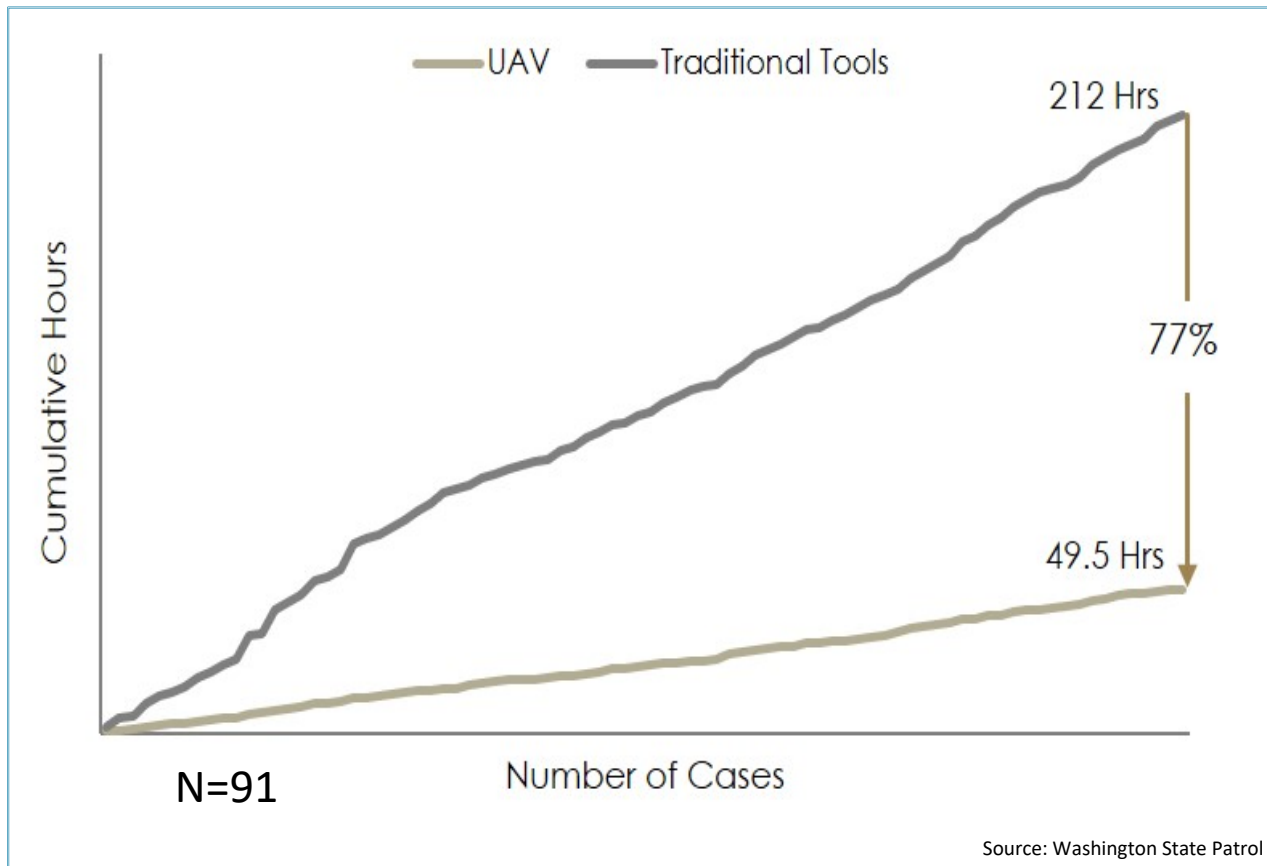


### 125 Deployments During 2018 Pilot Test

- UAVs provide **80% reduction** in road closure time compared to other methods to measure scenes.
- The estimated fiscal impact of road closures is \$350 per minute to the State in economic impact.
- The 2018 UAV pilot project provided an economic savings of **\$4,210,500**.
- Investigators are safer – they are not in the roadway taking measurements and they clear the scene quicker, minimizing exposure to risks.

# Evidence of Success.

## Washington State Patrol:



# Evidence of Success.

**Tippecanoe, IN Sheriff's Department:**

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Overall scene time was reduced by 60 percent with the use of UAS. In one example, the agency noted that an 800-foot crash scene was documented in a mere 22 minutes.



# Evidence of Success.

North Carolina State Highway Patrol:

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UAS was found to be 311% more efficient, requiring just 25 minutes to document a staged two-car collisions, while the 3D scanner required 1 hour and 51 minutes.

# Evidence of Success.

## Anecdotal Accounts from around the US:

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- Total station 3-4 hours down to 20-30 minutes.
- 3 Hours versus 45 minutes with UAS.
- 80 percent savings over traditional methods.
- Contract helicopter is \$400 per hour and UAS \$20.
- Cuts scene time to 1/5 and measuring time to 1/3.
- Average flight 15 minutes, taking hours off traffic backup.
- 3 Hours down to 15-30 minutes.
- Cleared a DUI crash in 1 hour versus 3 hours.
- 3 Hours to 15 minutes.
- More accurate than manual methods.

# Evidence of Success.

## Anecdotal Accounts from around the US:

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- 3 Hours to 15 minutes.
- 7 minute flight to cover a 3 acre scene.
- 75-80 percent reduction in mapping time.
- 4-5 hour crashes are cleared in half the time.
- Scenes processed in 1/3 the time of 3D scanners.
- 100 times more detail than manual measurements.
- 2-3 hours for total station with road closure now 15 min.
- UAV \$25 per hour versus \$600 for manned aircraft.
- “Hours” versus 20-40 minutes.
- Shorter road closures, quicker measurements.
- 1 and ½ hours to 15 minutes.



# Case Study: Improving Accuracy

## Michigan State Police:

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- A trailblazer in UAS by police, the first agency granted FAA authorization for statewide use.
- Early mapping sometimes 4'-5' variance on long measurements.
- Use of Ground Control Points (GCP) 20-40 feet apart improved accuracy to ½ inch.
- Now moving to the use of RTK GPS to achieve 3 cm accuracy.
- Moving to the use of 24" square placards instead of painting GCP on the scene.



Source: Michigan State Police

# Case Study: Public Engagement

## Austin, TX Police Department:

- Department held a series of three public meetings on their use of UAS.
- To both inform and seek public input.
- Hosted by Traffic Homicide Unit.
- Advertised through both social media and traditional media outlets.
- Provided details about crash investigations, officer safety, traffic congestion, and the value of UAS as a tool to see incidents from a different perspective.
- Officers answered questions about UAS, agency investigations, and policies.

JOIN THE APD VEHICULAR HOMICIDE UNIT AND  
**LEARN HOW DRONES WILL MAP  
THE SCENES OF FATAL CRASHES**



Tuesday, Aug. 28 @ 6 p.m.  
Westin Hotel (Domain) — 11301 Domain Drive

Wednesday, Aug. 29 @ 6 p.m.  
APD South Substation — 404 Ralph Ablanedo Drive

Wednesday, Sept. 5 @ 6 p.m.  
APD East Substation — 812 Springdale Road

THIS IS AN OPEN PUBLIC FORUM SEEKING PUBLIC'S INPUT. OFFICERS  
WILL BE AVAILABLE TO ANSWER ANY QUESTIONS YOU MAY HAVE!



Source: Austin Police Department

# Case Study: Time Savings

## Maine State Police:

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- The Maine State Police worked with stakeholders to ensure the new law would allow UAS for crash.
- 6 similar commercial vehicle crashes show benefits of UAS.
- 3 crashes used total station/3 UAS.
- Total station required multi-hour total closure for 2 and shoulder closure for the other crash.
- None of the 3 UAS cases involved total road closure; 11 minutes flight time; and wait time for wreckers.



Source: Maine State Police

# Case Study: Legislative Approval

## Stafford County, VA Sheriff's Office:

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- Virginia law restricted UAS use by police requiring warrant or imminent danger.
- Partnered with local Delegate to change the law to allow crash mapping.
- Worked with Virginia Department of Transportation and State Police to testify and provide statistics.
- Successful law change in 2018 now allows the use of UAS for crashes.
- Lead crash technician uses UAS, high-end laptop, and RTK GPS to process more than 20 scenes to date.



Source: Stafford County Sheriff



# Implementing UAS for TIM

## **Policy Formulation and Public Outreach:**

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Top down decision with everyone in the organization informed.

A concept of operations or staff study is needed.

Internal and external stakeholder engagement essential.

Agency policy should be restrictive, respecting 4<sup>th</sup> Amendment privacy rights.

The International Association of Police Chiefs (IACP) has a good sample policy for UAS.

Policy should include checklists and technical criteria for crash mapping and TIM applications.

A formal communications plan should be created.

Public and media outreach are needed to promote transparency.

# Implementing UAS for TIM

## **Transparency and Data Governance:**

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Flight data and every use of the UAS should be recorded.

Public complaints should be handled by the agency UAS coordinator.

Images and video should be treated like other police evidence.

How to collect, process, store, analyze, and disseminate images, video, and flight data must be planned.

Data storage and computing capability are important parts of a UAS program.

# Implementing UAS for TIM

## **Acquisition and Training:**

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Estimated entry cost is about \$8,000 - \$10,000.

Can use a vendor solution or agency procurement provided it is researched.

Variety of funding sources (forfeiture funds, state department of transportation) mostly agency budget dollars.

All pilots are certified by FAA every 2 years.

Implement proficiency training.

Require monthly flight training practicum.

# Implementing UAS for TIM

## **Program Evaluation:**

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Making the business case does not end with implementation.

Track direct cost savings, time savings, and other benefits of UAS to support program expansion and upgrades.

Document return on investment and cost benefit from the onset.

Work with transportation agencies to understand the indirect costs of congestion and factor savings into the bottom line.

Generate an annual report documenting use, benefits, and savings.

